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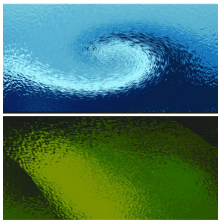

RESEARCH ARTICLE

Two crab species-Chinese mitten crab (*Eriocheir sinensis* Edw.) and mud crab (*Rhithropanopeus harrisii* (Gould) ssp. *tridentatus* (Maitland) in the Lithuanian coastal waters, Baltic Sea

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Abstract

1 - The main objective of this research was to overview both historical and recent data on two alien crab species-Chinese mitten crab (*Eriocheir sinensis* Milne-Edwards, 1854) and mud crab (*Rhithropanopeus harrisii* (Gould) ssp. *tridentatus* (Maitland) distribution in the Curonian Lagoon and coastal zone of the Baltic sea.

2 - Data collected since 1935 includes interviews with fishermen, popular science publications, museum collections and ichthyological monitoring.

3 - During the last two decades records of the mitten crabs became more frequent, probably representing changes in the commercial fishery regulations.

4 - Several gravid females of the mitten crab were caught in the coastal area of the Baltic Sea, however, larval development is not documented.

5 - Unlike the mitten crab, the mud crab distribution is restricted to the rapidly-changing salinity (0 to 7 psu) area.

Keywords: Baltic Sea, Curonian Lagoon, alien species, spatio-temporal distribution, biological invasion, zoobenthos.

Introduction

Chinese mitten crab (*Eriocheir sinensis* Edw.) originates from the south-eastern Asia (Leppakoski and Olenin 2000). In 1912 this species was noticed in Aller River near Hamburg (Germany) and has dispersed later to the neighbouring rivers and channels. In 1926 mitten crabs appeared in the Baltic Sea and distributed along the whole coastline (Ojaveer *et al.*, 2007 and references therein). Records of this species at the Lithuanian Baltic sea cost started from 1935 (Davidavičius, 1935, Valavičius, 1936).

Mitten crabs are predators and scavengers thus having particular role in the food web interactions. Moreover, during the mass occurrences, the negative economic effects of crabs could be observed, including impact on coast and bank erosion, loss in commercial fisheries and aquaculture (Leppäkoski *et al.*, 2002, Gollasch, 2006).

Mud crab (*Rhithropanopeus harrisii* (Gould) ssp. *tridentatus* (Maitland) originates from Atlantic coast of America, mostly in the Mexico bay and New Brunswick river delta. At the end of 19th century they appeared in Europe and now are distributed in the coastal zones of the Baltic, North, Black and Azov seas. Ship ballast waters are supposed to be main

spreading way of the species (Leppäkoski, Olenin, 2000). First observations of mud crab in the Baltic Sea comes from the Polish coast and Vistula Lagoon in 1951 (Nikolaev, 1951, Demel, 1953) and later this species became a constant component of the fauna of the Vistula Lagoon and Dead Vistula River. Several aspects of the mud crab biology and ecology, including population dynamics, morphological characteristics and life cycle and the functional role have been studied in the Vistula Lagoon ecosystem (*e.g.* Turoboyski, 1973, Janta 1996, Rychter 1997; Jazdzewski and Konopacka 2000; Normant *et al.*, 2004).

This work is aimed to overview existing data on two crab species in the Curonian Lagoon and the Lithuanian coastal zone, SE Baltic Sea. Invasion history, recent distribution and morphological characteristics of these two invasive crabs are presented.

Material and Methods

The Lithuanian coastal waters comprise the mesohaline (7-8 PSU) waters of the Baltic Proper and oligohaline-to-freshwater (0-3 PSU) of the Curonian Lagoon. The Lagoon is mostly freshwater, shallow eutrophic water body characterised by frequently changing salinity (0 to 7 PSU) in its northern part. Detailed description of the environmental characteristics of the study site is given in Olenin and Daunys, 2004 and Gasiūnaitė *et al.*, 2008.

This study is based on the qualitative data, collected since 1935 in the Lithuanian coastal zone of the south-eastern Baltic Sea and Curonian Lagoon (Fig. 1).

Historical data used for this study comes from different sources including interviews with fishermen, popular science publications and museum collections (Kaunas Zoological Museum of Tadas Ivanauskas, Rusnė Hydrobiological Station and Ventės Ragas Hydrobiological Station of the Institute of Ecology).

Additionally, data about recent crab by-catch in the gill nets and eel traps both in the Curonian Lagoon and Baltic Sea are used. Information from the commercial fishermen is included in this study, however, basic data on crab by-catch are available from the

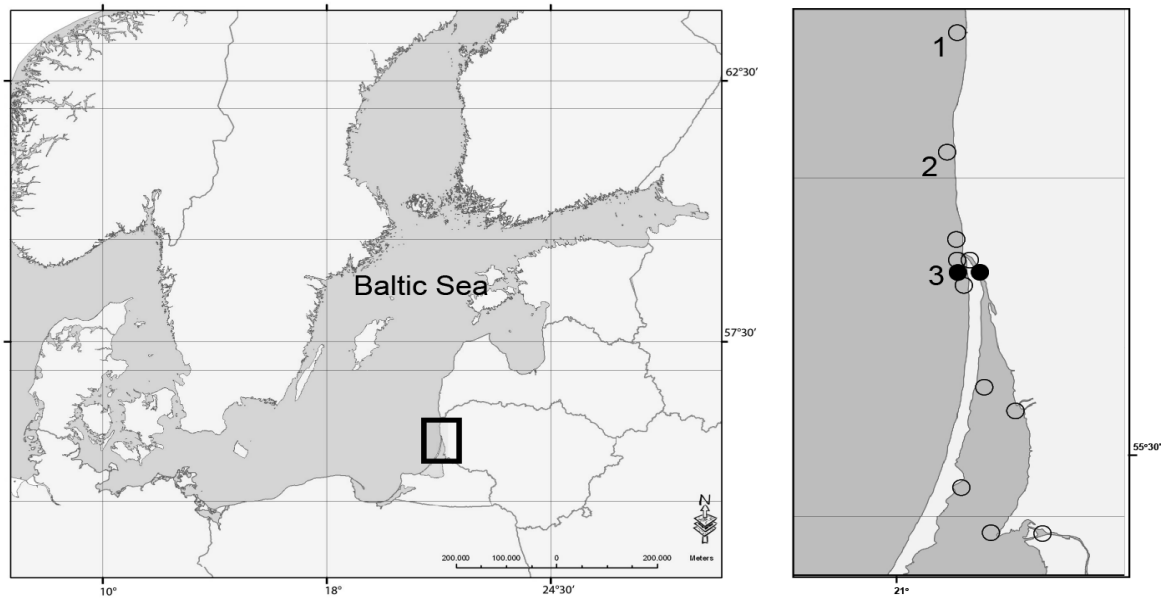

Fig. 1. Study site. Monitoring stations are marked by numbers. Open and filled circles- finding sites of the mitten and mud crab respectively.

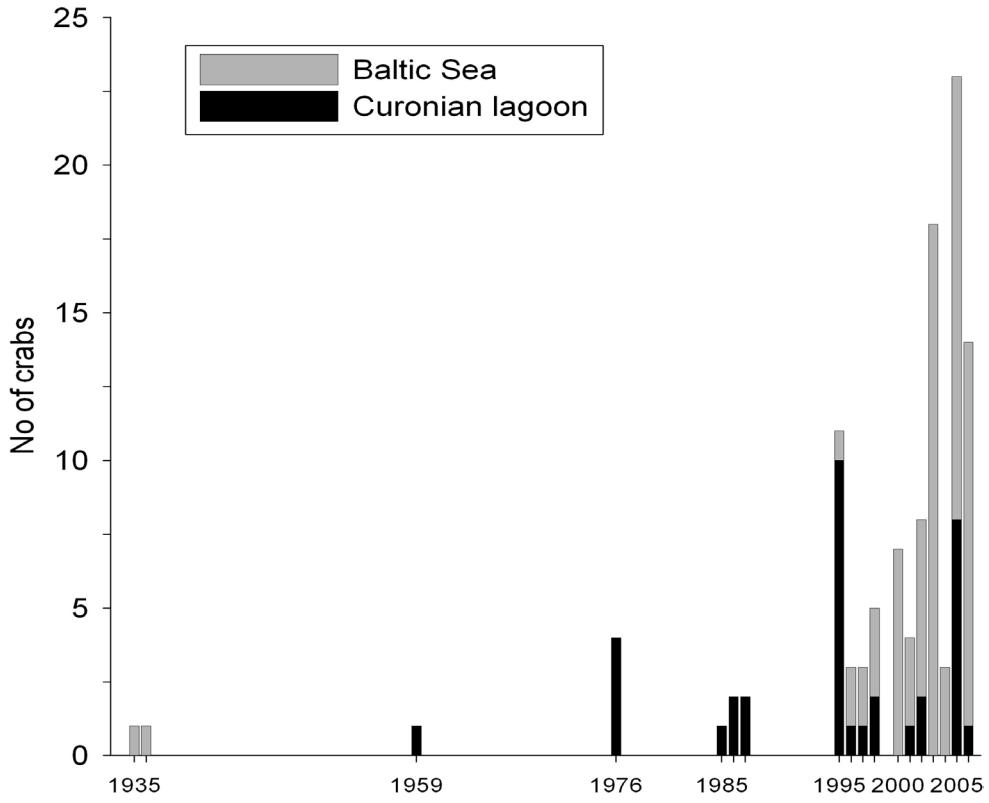

Fig. 2. Annual dynamics of the mitten crab observations in the Baltic Sea and Curonian Lagoon.

ichthyological monitoring in the shallow Baltic coastal waters (6-10 m depth, stations 1-3, Fig. 1), started from 1993 and performed by the Fishery Research Laboratory of Lithuanian State Centre for Pisciculture and Fishery Research. The gill net fishing was carried out 1-4 times per month using commercial and experimental nets (net mesh size = 20–55 mm; HELCOM 2006).

Data from the monitoring station 3 (Fig. 1) for the period of 1995-2006 was used to describe seasonal pattern of the mitten crab observations.

Crabs were identified to species level according to Buitendijk and Holthuis, 1949, Panning, 1952, Köhn and Gosselck, 1989. Length and width of crabs' carapaces were measured with a sliding callipers (± 0.1 mm), animals were weighted wet (± 0.1 g) and sex determined from the abdominal structure.

Results and Discussion

Mitten crab

Chinese mitten crab is distributed both in the Baltic Sea coastal zone and Curonian Lagoon (Fig. 1). Since 1935, 81 specimens were caught by gill nets at the shallow Baltic coastal waters up to 10 m depth. According to the Fishery Research Laboratory (Lithuanian State Centre for Pisciculture and Fishery Research) data, crabs were never found in the trawling samples at the depth of 20-80 m.

In the Curonian Lagoon 36 crabs were caught by the gill nets and eel traps for the period of 1952-2006. Frequency of the crab by-catch newer exceeded 1 individual per one net or trap except one occasion in July 1995, when five individuals were found in the eel trap.

During the last two decades records of Chinese mitten crab by-catch increased both in the Curonian Lagoon and Lithuanian coastal zone of the Baltic Sea (Fig. 2.).

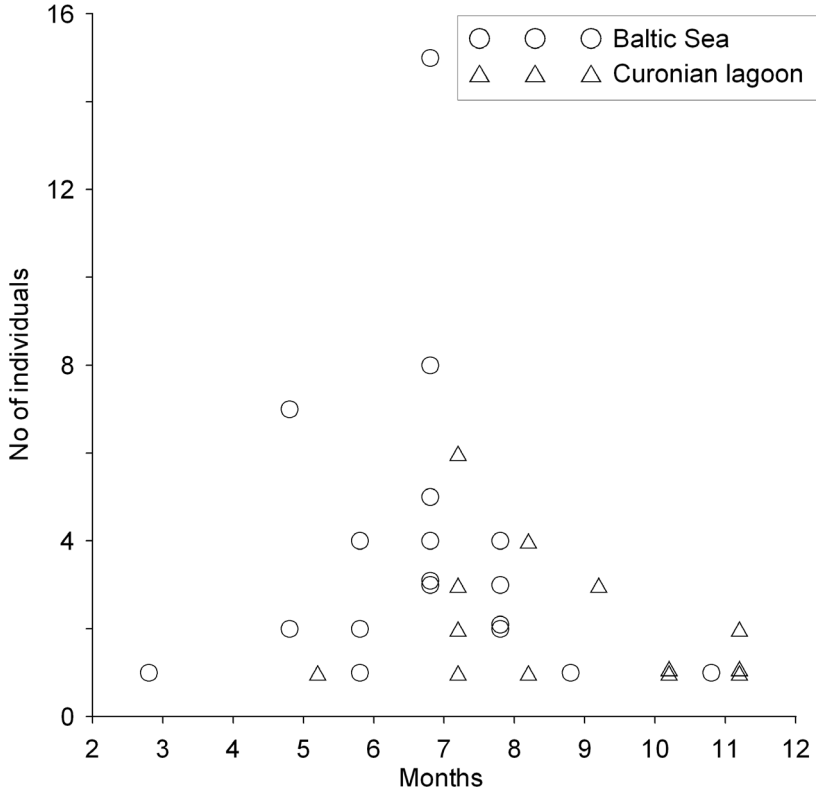

Fig. 3. Monthly dynamics of the mitten crab by-catch in the monitoring station 3 (see Fig. 1).

However, this fact possibly could not reflect the real growth of the crab population. One of the reasons could be restarted commercial fishery in the Baltic Sea coastal area after the re-establishment of Lithuanian independence at 1990 and therefore increased fishermen reports about the crab findings in the nets. On the other hand, increasing of the mitten crab population was also reported from several regions of NE Baltic and could be explained by the realtively mild winters and, therefore, more favourable conditions for the species survival (Ojaveer *et al.* 2007).

Crab records are available from March to November; nevertheless, most of the findings were reported from the summer- early autumn period (Fig. 3).

Morphometric parameters of the mitten crabs (Table 1) are similar to those described in other studies (Normant *et al.*, 2002, Ojaveer *et al.*, 2007).

Several females with eggs in oviducts and carrying eggs on pleopods were caught in June 2003 (1 individual) and 2005 (1 individual) in the Lithuanian coastal area. According to the unpublished data of Marine Research Centre of the Lithuanian Ministry of Environment, monthly average water temperature at the sampling sites was 17.5 and 18.6 ° C, salinity – 6 and 6.5 psu respectively. Female with eggs was also reported from the Polish coast in summer 2002 (Skora, pers. comm.). However, it is supposed, that mitten crabs are unable to reproduce in the low salinity conditions (Anger, 1991). Until now, there is no published data on larval stages in the Baltic zooplankton field and crab migration from the higher salinity areas could be an only source for the Baltic population (Ojaveer *et al.*, 2007).

Mud crab

First observations of mud crabs in the Lithuanian waters were documented at 2000

Table 1. Morphometric parameters of Chinese mitten crab. Data are given as min-max, average ± SD and n.

Parameter	Baltic Sea		Curonian Lagoon	
	Males	Females	Males	Females
Carapace height, mm	45-78 55.1±8.2 n=46	50-60 56.0± 3.6 n= 6	46-70 58.7± 7.1 n=21	50-60 53.3± 5.7 n=3
Carapace width, mm	45-80 60.9± 10,0 n=34	54-60 56.4± 2.5 n=6	46-70 60.0± 7.9 n =11	no data
Wet weight, g	52.9- 232 123.0±45.6 n=15	49-110 84.8+ 23.8 n=5	no data	no data

in the benthic grab samples from Klaipeda port area (Bubinas, pers. comm.) at the 6-12 m depth in the area of rapidly changing salinity in the range of 0 up to 7 psu (see Gasiūnaitė *et al.*, 2008). At the same year mud crab fragments (carapace and chelae) were found in the guts of round goby (*Neogobius melanostomus*) and perch (*Perca fluviatilis*) caught in the coastal area near the Klaipeda port (Bacevičius, unpubl.). Spatial distribution of the species is restricted to the port area and adjacent Baltic coastal zone (Fig. 1). Mud crabs could be found as by catch in the gill nets (mesh size 45 and 25 mm).

Carapace width of 13 males and one female was measured; mean carapace width was 17.0±5.0 mm with the range of 9-22 mm. Results of the more detailed study in the Vistula Lagoon show a similar pattern: carapace width range 4.9 - 22.4 mm, highest frequency observed in the 9.1-13.5 mm width class (Normant *et al.*, 2004). Unlike the mitten crab, mud crab could reproduce in the Baltic and maintain a stable population (Normant *et al.*, 2004), however, the life cycle of this species in the Curonian Lagoon is still unclear.

Conclusions

During the whole spreading history no mass development of Chinese mitten crab population was observed in the Lithuanian coastal zone of the Baltic Sea up to 10 m depth and Curonian Lagoon (mean depth-3.8 m). Recent increase of the frequency of mitten crab observations is probably representing changes in the commercial fishery regulations. Several gravid females of the mitten crab were caught in the coastal area of the Baltic Sea.

Mud crab distribution is spatially more concentrated and restricted to the rapidly-changing salinity (0 to 7 psu) area.

In general, the information about the abundance, life cycle and functional role of both crab species is still lacking.

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